

Unsteady Fluid Dynamic Loads

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SYMPOSIA DISCUSSION

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DISCUSSOR'S NAME: C. Ciray

AUTHOR'S NAME: P. Genalis

QUESTION:

Can you elaborate on ship based heavy lift aircraft? Should the aircraft carrier be much bigger than the present ones?

AUTHOR'S REPLY:

No – C-120 size aircraft carriers, about 1000 foot deck, but need to eliminate carrier island.

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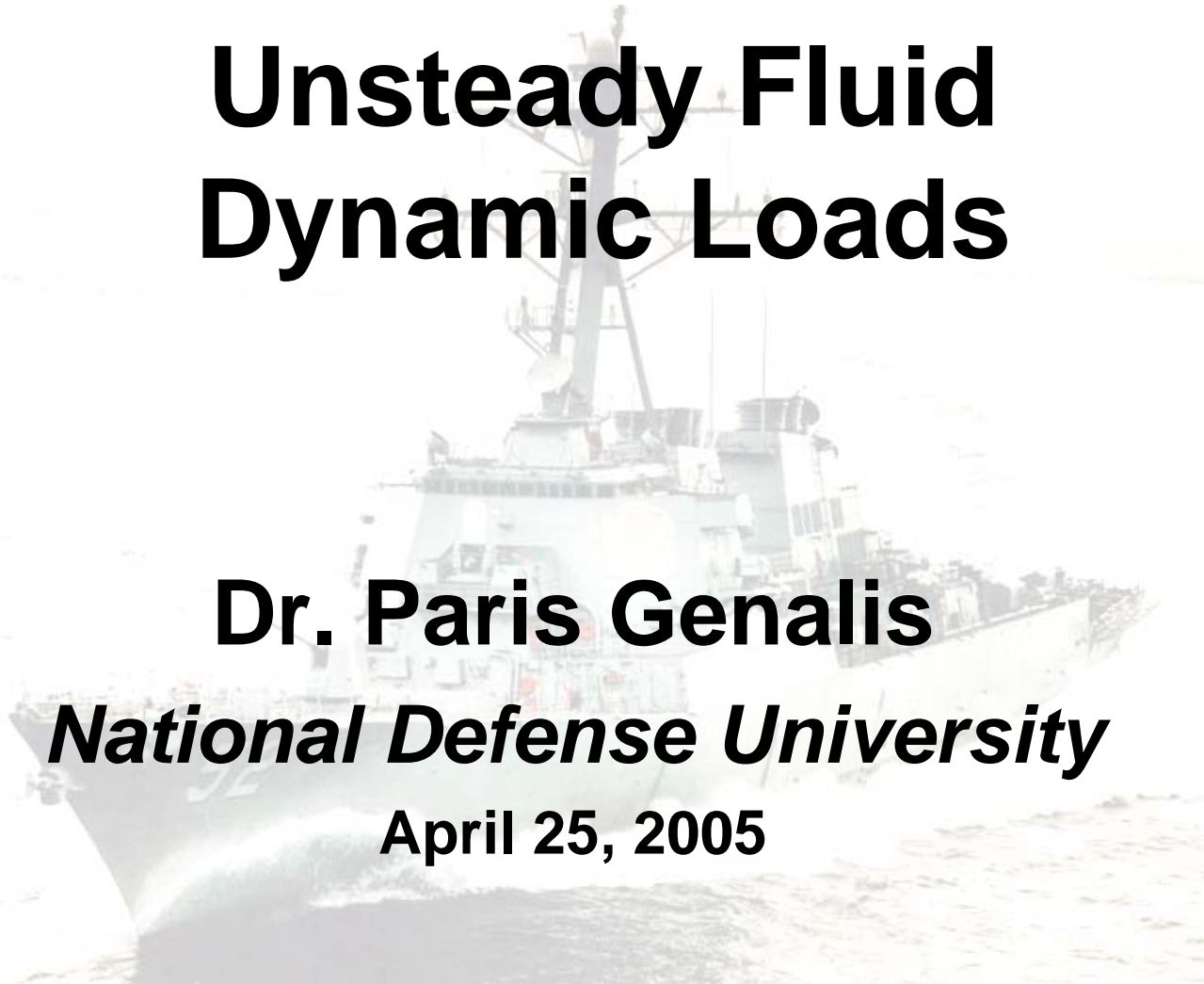


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April 25, 2005



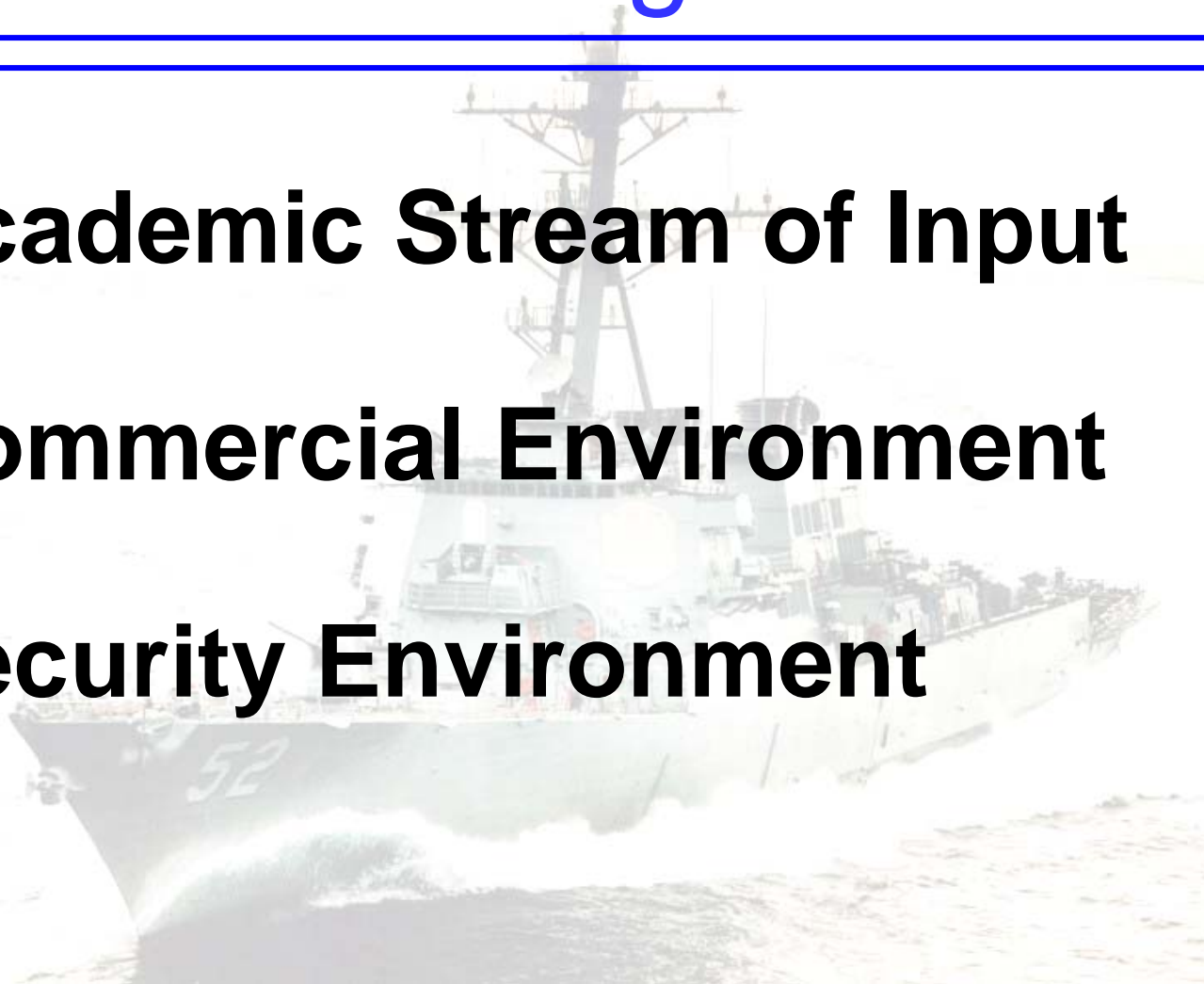
Unsteady Fluid Dynamic Loads

Objective

- To provide a perspective on the overall strength of research, development and design capabilities that currently exist in the U.S. regarding Naval Architecture
 - and how the impact of the work each of you is doing in unsteady load prediction influences those capabilities

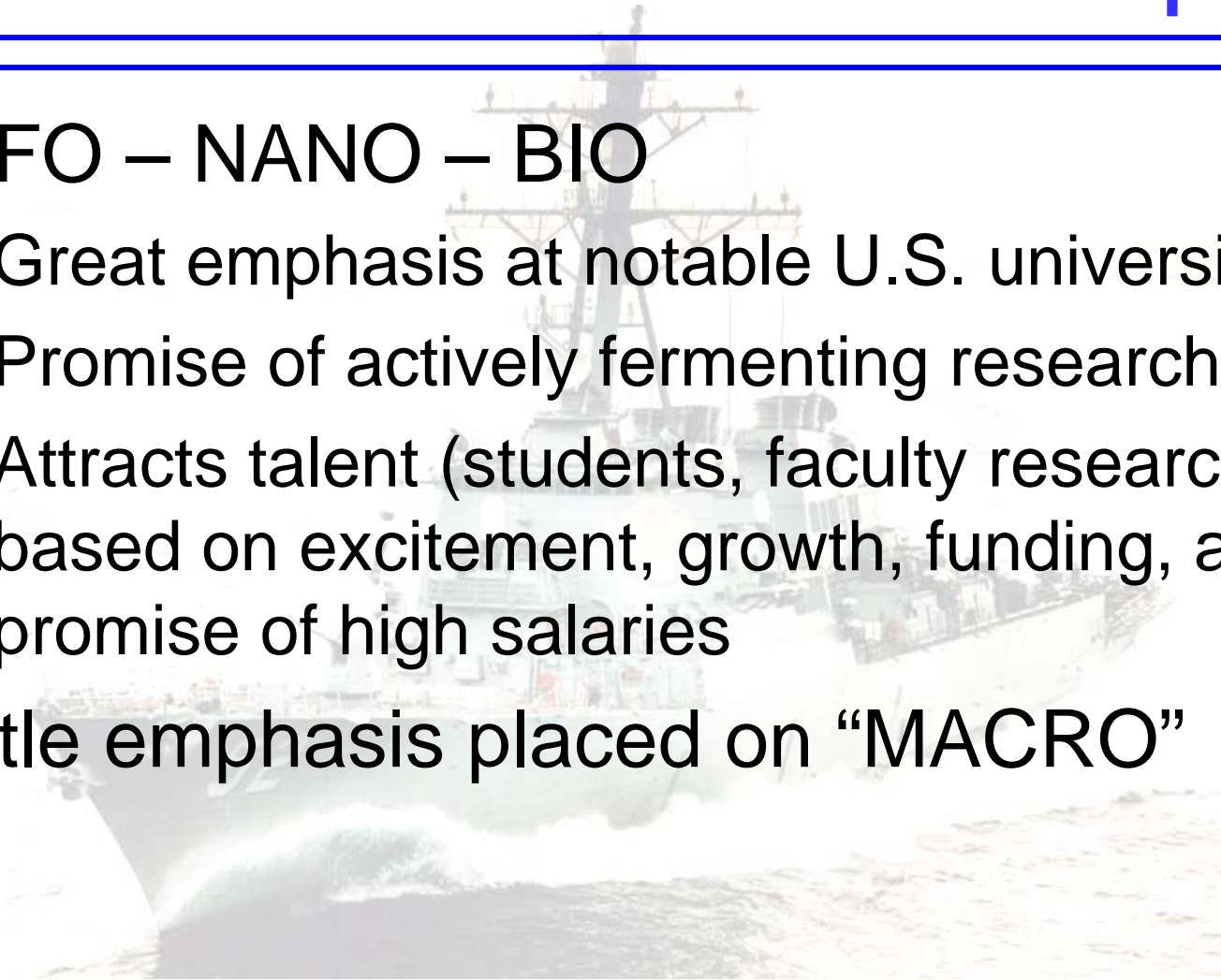
Influencing Factors

- **Academic Stream of Input**
- **Commercial Environment**
- **Security Environment**



Academic Stream of Input

- INFO – NANO – BIO
 - Great emphasis at notable U.S. universities
 - Promise of actively fermenting research
 - Attracts talent (students, faculty researchers) based on excitement, growth, funding, and promise of high salaries
- Little emphasis placed on “MACRO”



Academic Stream of Input

- **MACRO**
 - **Where all “Info – Nano – Bio” find application**
 - **Defense and commerce still rely on platforms**
 - they have shapes, motion, structure of modern materials, operate in an environment that imposes loads
 - **Very challenging problems**
 - Require all capability developed in these other disciplines, and then some
 - Challenge other disciplines with new problem formulation and ways to look at problems
- **Every bit as exciting**

Academic Stream of Input

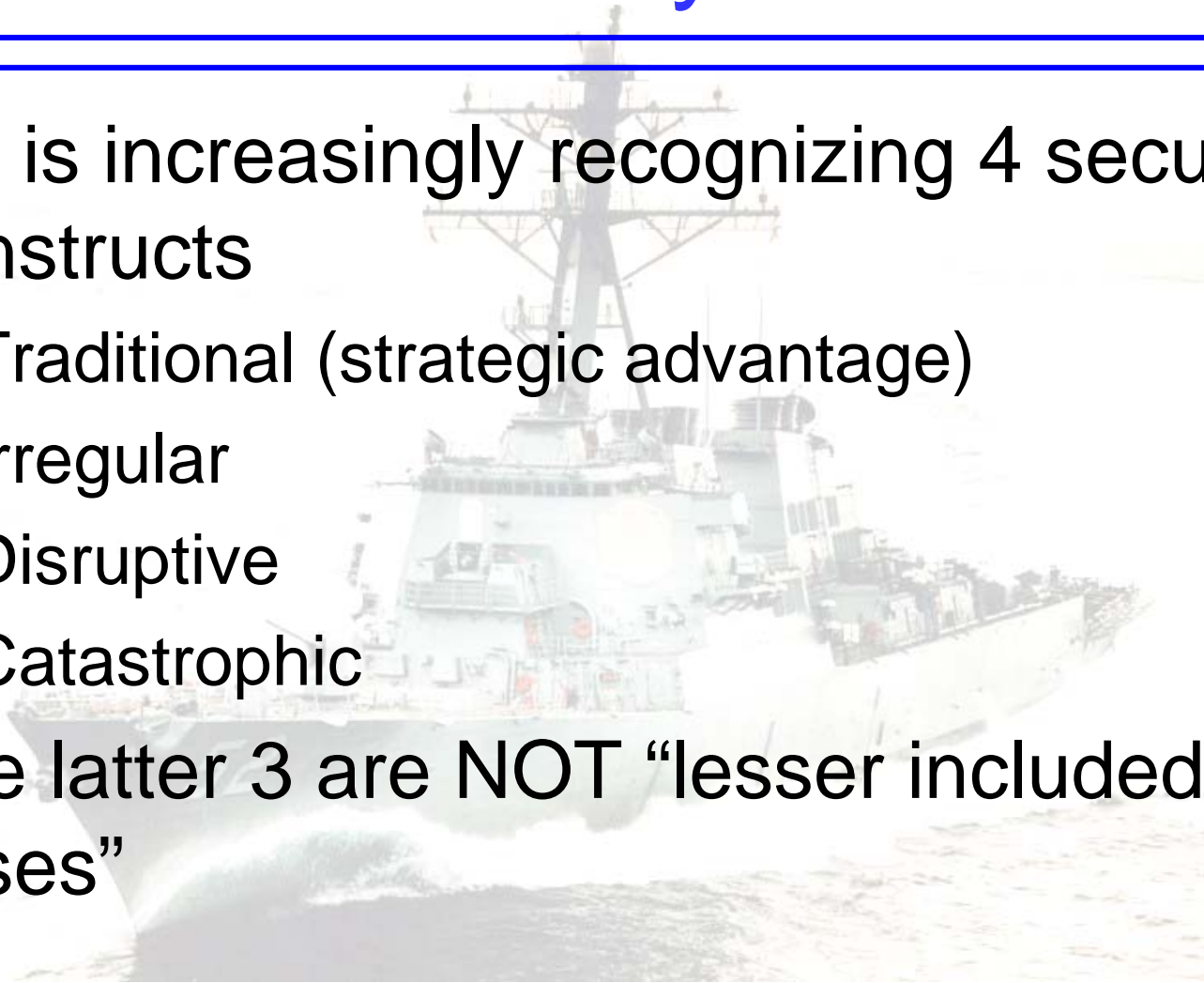
- MACRO
 - BUT WE HAVE NOT DONE A GOOD JOB OF CONVEYING THIS FACT TO PEOPLE OUTSIDE OUR COMMUNITY
 - Guilty of drifting to the abstract and away from the realities of design
 - Decoupling from the customer never pays off.
 - Need to take remedial action
 - Attract talent – takes effort, time
 - Work with customer – develop design tools

The New Commercial Environment

- U.S. shipbuilding business has not been commercially competitive. (Strong in military ship domain)
- International shipbuilding has seen a boom in fast ship designs – ferries with advanced hull shapes.
 - Usually coastal restrictions apply, somewhat easing the demand for advanced load predictions
- Aircraft business enjoys robust international competition (Boeing and Airbus)
 - Loads come from one fluid – no free surface complications

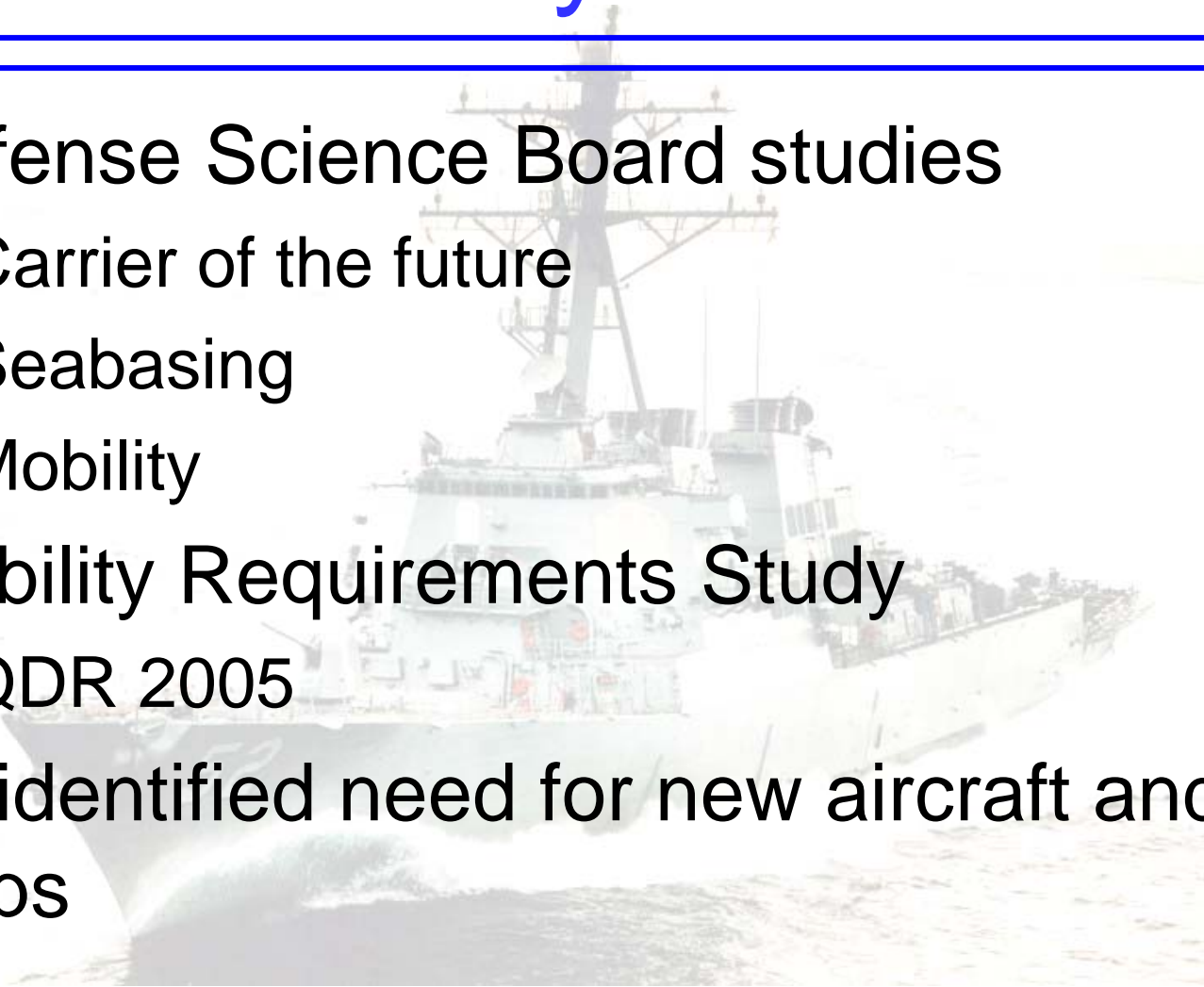
The New Security Environment

- US is increasingly recognizing 4 security constructs
 - Traditional (strategic advantage)
 - Irregular
 - Disruptive
 - Catastrophic
- The latter 3 are NOT “lesser included cases”



New Security Environment

- Defense Science Board studies
 - Carrier of the future
 - Seabasing
 - Mobility
- Mobility Requirements Study
 - QDR 2005
- All identified need for new aircraft and ships



New Security Environment

- Require new kinds of platforms (in addition to traditional ones)
 - More (cheaper), smaller, faster, netted ships
 - **Advanced hull forms (similar to commercial, inspired by...,)**
 - **Steel may be too heavy**
 - **Need to be open-ocean capable**
 - **Finite life vs. economic replacement**
 - **Load prediction is key**
 - Ship-based heavy lift aircraft

The Challenge – Staying close to the customer

- Reliable, accurate load estimates needed for design
- Today – accurate probably means many hours of computing (Navier Stokes solvers necessary); potential flow solutions are quick but not up to task for ship life prediction.
- Always – designers need quick turn around of analysis results; many iterations

The Challenge – ONR Response

- National Naval Responsibility – Naval Engineering program
 - **Emphasis on design tools of all kinds - broader than just load prediction**
 - **Level of sophistication of tools can (must?) be transparent to user (also open to other researchers)**
- New program on exploring the limits of numerical power of highly parallel machines in load prediction